



SEQUENCE LISTING

<110> COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH

<120> STABLE GENE VARIANTS OF LIPASES

<130> 71914

<140> US 10/768,951

<141> 2004-01-29

<160> 12

<170> PatentIn version 3.1

<210> 1

<211> 181

<212> PRT

<213> Bacillus subtilis

<220>

<221> AMINO ACIDS

<222> (1)..(181)

<223> enzyme sequence

<400> 1

Met Ala Glu His Asn Pro Val Val Met Val His Gly Ile Gly Gly Ala
1 5 10 15

Ser Phe Asn Phe Ala Gly Ile Lys Ser Tyr Leu Val Ser Gln Gly Trp
20 25 30

Ser Arg Asp Lys Leu Tyr Ala Val Asp Phe Trp Asp Lys Thr Gly Thr
35 40 45

Asn Tyr Asn Asn Gly Pro Val Leu Ser Arg Phe Val Gln Lys Val Leu
50 55 60

Asp Glu Thr Gly Ala Lys Lys Val Asp Ile Val Ala His Ser Met Gly
65 70 75 80

Gly Ala Asn Thr Leu Tyr Tyr Ile Lys Asn Leu Asp Gly Gly Asn Lys
85 90 95

Val Ala Asn Val Val Thr Leu Gly Gly Ala Asn Arg Leu Thr Thr Gly
100 105 110

Lys Ala Leu Pro Gly Thr Asp Pro Asn Gln Lys Ile Leu Tyr Thr Ser

115

120

125

Ile Tyr Ser Ser Ala Asp Met Ile Val Met Asn Tyr Leu Ser Arg Leu
 130 135 140

Asp Gly Ala Arg Asn Val Gln Ile His Gly Gly His Ile Gly Leu Leu
 145 150 155 160

Tyr Ser Ser Gln Val Asn Ser Leu Ile Lys Glu Gly Leu Asn Gly Gly
 165 170 175

Gly Gln Asn Thr Asn
 180

<210> 2
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 <213> Bacillus subtilis

<220>
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 <222> (1)..(181)
 <223> Protein sequence

<400> 2

Met Ala Glu His Asn Pro Val Val Met Val His Gly Ile Gly Gly Ala
 1 5 10 15

Ser Phe Asn Phe Ala Gly Ile Lys Ser Tyr Leu Val Ser Gln Gly Trp
 20 25 30

Ser Arg Asp Lys Leu Tyr Ala Val Asp Phe Trp Asp Lys Thr Gly Thr
 35 40 45

Asn Tyr Asn Asn Gly Pro Val Leu Ser Arg Phe Val Gln Lys Val Leu
 50 55 60

Asp Glu Thr Gly Ala Lys Lys Val Asp Ile Val Ala His Ser Met Gly
 65 70 75 80

Gly Ala Asn Thr Leu Tyr Tyr Ile Lys Asn Leu Asp Gly Gly Asn Lys
 85 90 95

Val Ala Asn Val Val Thr Leu Gly Gly Ala Asn Arg Leu Thr Thr Gly

100 105 110
 Lys Ala Leu Pro Gly Thr Asp Pro Asn Gln Lys Ile Leu Tyr Thr Ser
 115 120 125
 Ile Tyr Ser Ser Ala Asp Met Ile Val Met Asn Tyr Leu Ser Arg Leu
 130 135 140
 Asp Gly Ala Arg Asn Val Gln Ile His Gly Gly His Ile Gly Leu Leu
 145 150 155 160
 Tyr Ser Ser Gln Val Tyr Ser Leu Ile Lys Glu Gly Leu Asn Gly Gly
 165 170 175
 Gly Gln Asn Thr Asn
 180

<210> 3
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 <212> PRT
 <213> Bacillus subtilis

<220>
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 <222> (1)..(181)
 <223> Protein sequence

<400> 3

Met Ala Glu His Asn Pro Val Val Met Val His Gly Ile Gly Gly Ala
 1 5 10 15
 Ser Phe Asn Phe Ala Gly Ile Lys Ser Tyr Leu Val Ser Gln Gly Trp
 20 25 30
 Ser Arg Asp Lys Leu Tyr Ala Val Asp Phe Trp Asp Lys Thr Gly Thr
 35 40 45
 Asn Tyr Asn Asn Gly Pro Val Leu Ser Arg Phe Val Gln Lys Val Leu
 50 55 60
 Asp Glu Thr Gly Val Lys Lys Val Asp Ile Val Ala His Ser Met Gly
 65 70 75 80
 Gly Ala Asn Thr Leu Tyr Tyr Ile Lys Asn Leu Asp Gly Gly Asn Lys

85

90

95

Val Ala Asn Val Val Thr Leu Gly Gly Ala Asn Arg Leu Thr Thr Gly
 100 105 110

Lys Ala Leu Pro Gly Thr Asp Pro Asn Gln Lys Ile Leu Tyr Thr Ser
 115 120 125

Ile Tyr Ser Ser Asp Asp Met Ile Val Met Asn Tyr Leu Ser Arg Leu
 130 135 140

Asp Gly Ala Arg Asn Val Gln Ile His Gly Gly His Ile Gly Leu Leu
 145 150 155 160

Tyr Ser Ser Gln Val Tyr Ser Leu Ile Lys Glu Gly Leu Asn Gly Gly
 165 170 175

Gly Gln Asn Thr Asn
 180

<210> 4
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<220>
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 <222> (1)..(181)
 <223> Protein Sequence

<400> 4

Met Ala Glu His Asn Pro Val Val Met Val His Gly Ile Gly Gly Ala
 1 5 10 15

Ser Phe Asn Phe Ala Gly Ile Lys Ser Tyr Leu Val Ser Gln Gly Trp
 20 25 30

Ser Arg Asp Lys Leu Tyr Ala Val Asp Phe Trp Asp Lys Thr Gly Thr
 35 40 45

Asn Tyr Asn Asn Gly Pro Val Leu Ser Arg Phe Val Gln Lys Val Leu
 50 55 60

Asp Glu Thr Gly Thr Lys Lys Val Asp Ile Val Ala His Ser Met Gly

65					70					75						80
Gly	Ala	Asn	Thr	Leu	Tyr	Tyr	Ile	Lys	Asn	Leu	Asp	Gly	Gly	Asn	Lys	
				85					90					95		
Val	Ala	Asn	Val	Val	Thr	Leu	Gly	Gly	Ala	Asn	Arg	Leu	Thr	Thr	Gly	
			100					105					110			
Lys	Ala	Pro	Pro	Gly	Thr	Asp	Pro	Asn	Gln	Lys	Ile	Leu	Tyr	Thr	Ser	
		115					120					125				
Ile	Tyr	Ser	Ser	Ala	Asp	Met	Ile	Val	Met	Asn	Tyr	Leu	Ser	Arg	Leu	
	130					135					140					
Asp	Gly	Ala	Arg	Asn	Val	Gln	Ile	His	Gly	Gly	His	Ile	Gly	Leu	Leu	
145					150					155					160	
Tyr	Ser	Ser	Gln	Val	Tyr	Ser	Leu	Ile	Lys	Glu	Gly	Leu	Asn	Gly	Gly	
				165					170					175		
Gly	Gln	Asn	Thr	Asn												
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Met	Ala	Glu	His	Asn	Pro	Val	Val	Met	Val	His	Gly	Ile	Gly	Gly	Ala	
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Ser	Phe	Asn	Phe	Ala	Gly	Ile	Lys	Ser	Tyr	Leu	Val	Ser	Gln	Gly	Trp	
			20					25					30			
Ser	Arg	Asp	Lys	Leu	Tyr	Ala	Val	Asp	Phe	Trp	Asp	Lys	Thr	Gly	Thr	
		35					40					45				
Asn	Tyr	Asn	Asn	Gly	Pro	Val	Leu	Ser	Arg	Phe	Val	Gln	Lys	Val	Leu	

50

55

60

Asp Glu Thr Gly Ala Lys Lys Val Asp Ile Val Ala His Ser Met Gly
65 70 75 80

Gly Ala Asn Thr Leu Tyr Tyr Ile Lys Asn Leu Asp Gly Gly Asn Lys
85 90 95

Val Ala Asn Val Val Thr Leu Gly Gly Ala Asn Arg Leu Thr Thr Gly
100 105 110

Lys Ala Leu Pro Gly Thr Asp Pro Asn Gln Lys Ile Leu Tyr Thr Ser
115 120 125

Ile Tyr Ser Ser Asp Asp Met Ile Val Met Asn Tyr Leu Ser Arg Leu
130 135 140

Asp Gly Ala Arg Asn Val Gln Ile His Gly Gly His Ile Gly Leu Leu
145 150 155 160

Tyr Ser Ser Gln Val Tyr Ser Leu Ile Lys Glu Gly Leu Asn Gly Gly
165 170 175

Gly Gln Asn Thr Asn
180

<210> 6
<211> 181
<212> PRT
<213> Bacillus subtilis

<220>
<221> Amino acid
<222> (1)..(181)
<223> Protein sequence

<400> 6

Met Ala Glu His Asn Pro Val Val Met Val His Gly Ile Gly Gly Ala
1 5 10 15

Ser Phe Asn Phe Ala Gly Ile Lys Ser Tyr Leu Val Ser Gln Gly Trp
20 25 30

Ser Arg Asp Lys Leu Tyr Ala Val Asp Phe Trp Asp Lys Thr Gly Thr

35

40

45

Asn Tyr Asn Asn Gly Pro Val Leu Ser Arg Phe Val Gln Lys Val Leu
50 55 60

Asp Glu Thr Gly Ala Lys Lys Val Asp Ile Val Ala His Ser Met Gly
65 70 75 80

Gly Ala Asn Thr Leu Tyr Tyr Ile Lys Asn Leu Asp Gly Gly Asn Lys
85 90 95

Val Ala Asn Val Val Thr Leu Gly Gly Ala Asn Arg Leu Thr Thr Gly
100 105 110

Lys Ala Pro Pro Gly Thr Asp Pro Asn Gln Lys Ile Leu Tyr Thr Ser
115 120 125

Ile Tyr Ser Ser Asp Asp Met Ile Val Met Asn Tyr Leu Ser Arg Leu
130 135 140

Asp Gly Ala Arg Asn Val Gln Ile His Gly Gly His Ile Gly Leu Leu
145 150 155 160

Tyr Ser Ser Gln Val Tyr Ser Leu Ile Lys Glu Gly Leu Asn Gly Gly
165 170 175

Gly Gln Asn Thr Asn
180

<210> 7
<211> 181
<212> PRT
<213> Bacillus subtilis

<220>
<221> Amino acid
<222> (1)..(181)
<223> Protein sequence

<400> 7

Met Ala Glu His Asn Pro Val Val Met Val His Gly Ile Gly Gly Ala
1 5 10 15

Ser Phe Asn Phe Ala Gly Ile Lys Ser Tyr Leu Val Ser Gln Gly Trp

20

25

30

Ser Arg Asp Lys Leu Tyr Ala Val Asp Phe Trp Asp Lys Thr Gly Thr
 35 40 45

Asn Tyr Asn Asn Gly Pro Val Leu Ser Arg Phe Val Gln Lys Val Leu
 50 55 60

Asp Glu Thr Gly Ala Lys Lys Val Asp Ile Val Ala His Ser Met Gly
 65 70 75 80

Gly Ala Asn Thr Leu Tyr Tyr Ile Lys Asn Leu Asp Gly Gly Asn Lys
 85 90 95

Val Ala Asn Val Val Thr Leu Gly Gly Ala Asn Arg Leu Thr Thr Gly
 100 105 110

Lys Ala Leu Pro Gly Thr Asp Pro Asn Gln Lys Ile Leu Tyr Thr Ser
 115 120 125

Ile Tyr Ser Ser Ala Asp Met Ile Val Met Asn Tyr Leu Ser Arg Leu
 130 135 140

Asp Gly Ala Ser Asn Val Gln Ile His Gly Gly His Ile Gly Leu Leu
 145 150 155 160

Tyr Ser Ser Gln Val Tyr Ser Leu Ile Lys Glu Gly Leu Asn Gly Gly
 165 170 175

Gly Gln Asn Thr Asn
 180

<210> 8
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 <213> Bacillus subtilis

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 <222> (1)..(181)
 <223> Protein sequence

<400> 8

Met Ala Glu His Asn Pro Val Val Met Val His Gly Ile Gly Gly Ala

1	5	10	15
Ser Phe Asn Phe Ala Gly Ile Lys Ser Tyr Leu Val Ser Gln Gly Trp	20	25	30
Ser Arg Asp Lys Leu Tyr Ala Val Asp Phe Trp Asp Lys Thr Gly Thr	35	40	45
Asn Tyr Asn Asn Gly Pro Val Leu Ser Arg Phe Val Gln Lys Val Leu	50	55	60
Asp Glu Thr Gly Ala Lys Lys Val Asp Ile Val Ala His Ser Met Gly	65	70	75
Gly Ala Asn Thr Leu Tyr Tyr Ile Lys Asn Leu Asp Gly Gly Asn Lys	85	90	95
Val Ala Asn Val Val Thr Leu Gly Gly Ala Asn Arg Leu Thr Thr Gly	100	105	110
Lys Ala Pro Pro Gly Thr Asp Pro Asn Gln Lys Ile Leu Tyr Thr Ser	115	120	125
Ile Tyr Ser Ser Ala Asp Met Ile Val Met Asn Tyr Leu Ser Arg Leu	130	135	140
Asp Gly Ala Arg Asn Val Gln Ile His Gly Gly His Ile Gly Leu Leu	145	150	155
Tyr Ser Ser Gln Val Tyr Ser Leu Ile Lys Glu Gly Leu Asn Gly Gly	165	170	175
Gly Gln Asn Thr Asn	180		

<210> 9
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 <212> PRT
 <213> Bacillus subtilis

 <220>
 <221> Amino acid
 <222> (1)..(181)
 <223> Portein Sequence

<400> 9

Met Ala Glu His Asn Pro Val Val Met Val His Gly Ile Gly Gly Ala
1 5 10 15

Ser Phe Asn Phe Ala Gly Ile Lys Ser Tyr Leu Val Ser Gln Gly Trp
20 25 30

Ser Arg Asp Lys Leu Tyr Ala Val Asp Phe Trp Asp Lys Thr Gly Thr
35 40 45

Asn Tyr Asn Asn Gly Pro Val Leu Ser Arg Phe Val Gln Lys Val Leu
50 55 60

Asp Glu Thr Gly Ala Lys Lys Ala Asp Ile Val Ala His Ser Met Gly
65 70 75 80

Gly Ala Asn Thr Leu Tyr Tyr Ile Lys Asn Leu Asp Gly Gly Asn Lys
85 90 95

Val Ala Asn Val Val Thr Leu Gly Gly Ala Asn Arg Leu Thr Thr Gly
100 105 110

Lys Ala Leu Pro Gly Thr Asp Pro Asn Gln Lys Ile Leu Tyr Thr Ser
115 120 125

Ile Tyr Ser Ser Ala Asp Met Ile Val Met Asn Tyr Leu Ser Arg Leu
130 135 140

Asp Gly Ala Arg Asn Val Gln Ile His Gly Gly His Ile Gly Leu Leu
145 150 155 160

Tyr Ser Ser Gln Val Tyr Ser Leu Ile Lys Glu Gly Leu Asn Gly Gly
165 170 175

Gly Gln Asn Thr Asn
180

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<212> PRT

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<220>

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<222> (1)..(181)
<223> Protein Sequence

<400> 10

Met Ala Glu His Asn Pro Val Val Met Val His Gly Ile Gly Gly Ala
1 5 10 15

Ser Phe Asn Phe Ala Gly Ile Lys Ser Tyr Leu Val Ser Gln Gly Trp
20 25 30

Ser Arg Asp Lys Leu Tyr Ala Val Asp Phe Trp Asp Lys Thr Gly Thr
35 40 45

Asn Tyr Asn Asn Gly Pro Val Leu Ser Arg Phe Val Gln Lys Val Leu
50 55 60

Asp Glu Thr Gly Ala Lys Lys Val Asp Ile Val Ala His Ser Met Gly
65 70 75 80

Gly Ala Asn Thr Leu Tyr Tyr Ile Lys Asn Leu Asp Gly Gly Asn Lys
85 90 95

Val Ala Asn Val Val Thr Leu Gly Gly Ala Asn Arg Leu Thr Thr Gly
100 105 110

Lys Ala Leu Pro Gly Thr Asp Pro Asn Gln Lys Ile Leu Tyr Thr Ser
115 120 125

Ile Tyr Ser Ser Ala Asp Met Ile Val Met Asn Tyr Leu Ser Arg Leu
130 135 140

Val Gly Ala Arg Asn Val Gln Ile His Gly Gly His Ile Gly Leu Leu
145 150 155 160

Tyr Ser Ser Gln Val Tyr Ser Leu Ile Lys Glu Gly Leu Asn Gly Gly
165 170 175

Gly Gln Asn Thr Asn
180

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<222> (1)..(181)
<223> Protein sequence

<400> 11

Met Ala Glu His Asn Pro Val Val Met Val His Gly Ile Gly Gly Ala
1 5 10 15

Ser Phe Asn Phe Ala Gly Ile Lys Ser Tyr Leu Val Ser Gln Gly Trp
20 25 30

Ser Arg Asp Lys Leu Tyr Ala Val Asp Phe Trp Asp Lys Thr Gly Thr
35 40 45

Asn Tyr Asn Asn Gly Pro Val Leu Ser Arg Phe Val Gln Lys Val Leu
50 55 60

Asp Glu Thr Gly Val Lys Lys Val Asp Ile Val Ala His Ser Met Gly
65 70 75 80

Gly Ala Asn Thr Leu Tyr Tyr Ile Lys Asn Leu Asp Gly Gly Asn Lys
85 90 95

Val Ala Asn Val Val Thr Leu Gly Gly Ala Asn Arg Leu Thr Thr Gly
100 105 110

Lys Ala Leu Pro Gly Thr Asp Pro Asp Gln Lys Ile Leu Tyr Thr Ser
115 120 125

Ile Tyr Ser Ser Asp Asp Met Ile Val Met Asn Tyr Leu Ser Arg Leu
130 135 140

Asp Gly Ala Arg Asn Val Gln Ile His Gly Gly His Ile Gly Leu Leu
145 150 155 160

Tyr Ser Ser Gln Val Tyr Ser Leu Ile Lys Glu Gly Leu Asn Gly Gly
165 170 175

Gly Gln Asn Thr Asn
180

<210> 12
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<213> Bacillus subtilis

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<222> (1)..(181)
<223> Protein sequence

<220>
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<222> (1)..(181)
<223> Protein sequence

<400> 12

Met Ala Glu His Asn Pro Val Val Met Val His Gly Ile Gly Gly Ala
1 5 10 15

Ser Phe Asn Phe Ala Gly Ile Lys Ser Tyr Leu Val Ser Gln Gly Trp
20 25 30

Ser Arg Asp Lys Leu Tyr Ala Val Asp Phe Trp Asp Lys Thr Gly Thr
35 40 45

Asn Tyr Asn Asn Gly Pro Val Leu Ser Arg Phe Val Gln Lys Val Leu
50 55 60

Asp Glu Thr Gly Ala Lys Lys Val Asp Ile Val Ala His Ser Met Gly
65 70 75 80

Gly Ala Asn Thr Leu Tyr Tyr Ile Lys Asn Leu Asp Gly Gly Asn Lys
85 90 95

Val Ala Asn Val Val Thr Leu Gly Gly Ala Asn Arg Leu Thr Thr Gly
100 105 110

Lys Ala Pro Pro Gly Thr Asp Pro Asp Gln Lys Ile Leu Tyr Thr Ser
115 120 125

Ile Tyr Ser Ser Asp Asp Met Ile Val Met Asn Tyr Leu Ser Arg Leu
130 135 140

Asp Gly Ala Arg Asn Val Gln Ile His Gly Gly His Ile Gly Leu Leu
145 150 155 160

Tyr Ser Ser Gln Val Tyr Ser Leu Ile Lys Glu Gly Leu Asn Gly Gly
165 170 175

Gly Gln Asn Thr Asn
180